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The Effect of Red Ginger (*Zingiber officinale* var. *rubrum* rhizoma) on Neutrophil Levels After Eccentric Exercise in Support of SDG 3

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DOI : <https://doi.org/10.63230/jocsis.3.1.259>

Sections Info

Article history:

Submitted: May 5, 2025

Final Revised: June 10, 2025

Accepted: July 1, 2027

First Available Online: July 16, 2026

Publication Date: March 27, 2027

Keywords:

Eccentric Exercise;

Exercise-Induced Muscle

Damage;

Inflammation;

Neutrophils;

Red Ginger.

ABSTRACT

Objective: Exercise-induced muscle damage (EIMD) following eccentric exercise triggers an acute inflammatory response characterized by increased neutrophil infiltration. Although non-steroidal anti-inflammatory drugs (NSAIDs) are commonly used to manage inflammation, their prolonged use may cause adverse effects. This study aimed to analyze the effect of red ginger (*Zingiber officinale* var. *rubrum*) extract on plasma neutrophil levels after eccentric exercise in untrained individuals as a natural anti-inflammatory strategy supporting SDG 3 (Good Health and Well-being). **Method:** The experimental study employed a randomized pretest-posttest control-group design involving 30 untrained medical students from Universitas Negeri Surabaya. Participants were randomly assigned to either a control group (placebo) or an experimental group receiving red ginger extract (n = 15 each). Blood samples were collected before exercise and after intervention to determine plasma neutrophil levels. Data were analyzed using normality tests followed by paired-sample t-tests with SPSS version 26. **Results:** The normality test confirmed that all variables were normally distributed ($p > 0.05$). The control group showed no significant change in plasma neutrophil levels after eccentric exercise ($p = 0.820$). In contrast, the experimental group demonstrated a significant reduction in neutrophil levels following red ginger supplementation ($p < 0.001$), indicating a decreased inflammatory response after exercise-induced muscle damage. **Novelty:** The study demonstrates the anti-inflammatory potential of red ginger extract using plasma neutrophil count as an early biomarker of EIMD after eccentric exercise. The findings provide evidence for a safe, affordable, and locally available natural alternative to conventional anti-inflammatory medication, contributing to healthier exercise recovery and supporting Sustainable Development Goal 3.

INTRODUCTION

An individual who does sports, whether an athlete, a trained or untrained layperson, will experience exercise-induced muscle damage (exercised-receptor damage/EIMD). EIMD occurs mainly in eccentric movements because fewer motor units are involved so that the mechanical stress on the muscle is greater (Douglas et al., 2017). EIMD is characterized by, among others, decreased muscle strength and pain (Hyldahl & Hubal, 2014), damage to muscle fibers (Heckel et al., 2019), sarcolemma and muscle extracellular matrix (Qian et al., 2023), and inflammation which, although it contributes to healing, also produces reactive oxygen species (ROS) (Bessa et al., 2016), so that it can reduce athlete performance and achievement and increase the number of sports contributions to society.

To reduce inflammation that occurs after exercise, both in the context of performance and recreation, anti-inflammatories are generally used, especially non-steroidal anti-inflammatory drugs (NSAIDs). However, long-term use of this drug causes 30% of hospitalizations due to drug side effects (Bindu et al., 2020), liver dysfunction